

Claims

1. A system, comprising:

a first discrete power amplifier; and

a second discrete power amplifier having an input terminal coupled to an output

5 terminal of the first discrete power amplifier, wherein the output power of the second discrete power amplifier is about 30 dBm or less.

2. The system of claim 1, wherein the first discrete power amplifier is

coupled to the second discrete power amplifier using a proprietary mechanical

10 interface.

3. The system of claim 1, further comprising:

a wireless local area network (WLAN) access point (AP) comprising the first discrete power amplifier; and

15 an add-on module coupled to the WLAN AP and comprising the second discrete power amplifier.

4. The system of claim 1, further comprising:

a first discrete low noise amplifier (LNA); and

20 a second discrete low noise amplifier (LNA) having an output terminal coupled to an input terminal of the first discrete low noise amplifier.

5. The system of claim 4, further comprising:

a first circulator having a first port coupled to the output terminal of the first discrete power amplifier and the input terminal of the first discrete low noise amplifier, a second port coupled to the input terminal of the second discrete power amplifier, and a
5 third port coupled to the output terminal of the second discrete low noise amplifier; and

a second circulator having a first port coupled to an output terminal of second discrete power amplifier and a second port coupled to an input terminal of the second discrete low noise amplifier.

10 6. The system of claim 5, further comprising a third discrete low noise amplifier (LNA) having an output terminal coupled to the input terminal of the first low noise amplifier.

7. The system of claim 6, further comprising:

a first switch;

a second switch;

a third switch having a first terminal coupled to an output terminal of the second

5 discrete power amplifier and a second terminal coupled to an input terminal of the second discrete LNA; and

a forth switch;

wherein the output terminal of the first discrete power amplifier is coupled to the input terminal of the second discrete power amplifier via the first and second switches;

10 and

wherein the output terminal of the second discrete LNA is coupled to the input terminal of the first discrete LNA via the second and fourth switches.

8. The system of claim 7, wherein the first switch, the second and the third

15 switch are coupled to receive a first control signal and the fourth switch is coupled to receive a second control signal.

9. The system of claim 6, further comprising:

a primary antenna coupled to an output terminal of second discrete power

20 amplifier and an input terminal of the second discrete low noise amplifier, wherein the primary antenna is a transmit and receive antenna; and

a diversity antenna coupled to an input terminal of the third discrete low noise amplifier, wherein the diversity antenna is a receive only antenna.

10. The system of claim 1, wherein the first discrete power amplifier has an output power of about 10 dBm.

5 11. The system of claim 1, wherein the first discrete power amplifier has an input terminal coupled to receive a radio frequency (RF) signal modulated using an orthogonal frequency division multiplexing (OFDM) modulation scheme.

12. A system, comprising:

10 a first discrete power amplifier having an input terminal coupled to receive a radio frequency (RF) signal adapted to communicate information using a wireless local area network (WLAN) communication protocol or a wireless metropolitan area network (WMAN) communication protocol; and

a second discrete power amplifier having an input terminal coupled to an output
15 terminal of the first discrete power amplifier.

13. The system of claim 12, wherein the WLAN communication protocol is a communication protocol substantially conforming to an Industrial Electrical and Electronics Engineers (IEEE) 802.11 standard.

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14. The system of claim 12, wherein the WMAN communication protocol is a communication protocol substantially conforming to an Industrial Electrical and Electronics Engineers (IEEE) 802.16 standard.

15. A system, comprising:

a first discrete power amplifier having an input terminal coupled to receive a signal modulated using an orthogonal frequency division multiplexing (OFDM)

5 modulation scheme; and

a second discrete power amplifier having an input terminal coupled to an output terminal of the first discrete power amplifier.

16. The system of claim 15, wherein the output power of the second discrete

10 power amplifier is about 30 dBm or less.

17. The system of claim 15, further comprising a primary antenna coupled to an output terminal of second discrete power amplifier.

18. The system of claim 17, further comprising:

a first discrete low noise amplifier (LNA); and

a second discrete low noise amplifier (LNA) having an input terminal coupled to the primary antenna and an output terminal coupled to an input terminal of the first discrete low noise amplifier .

19. The system of claim 18, further comprising:

a diversity antenna; and

a third discrete low noise amplifier (LNA) having an input terminal coupled to the diversity antenna and an output terminal coupled to the input terminal of the first low

5 noise amplifier.

20. A receive path to receive a radio frequency (RF) signal, comprising:

a first low noise amplifier (LNA); and

a second low noise amplifier (LNA) having an output terminal coupled to the
10 input terminal of the first low noise amplifier and wherein a noise figure of the second low noise amplifier is less than a noise figure of the first low noise amplifier.

21. The receive path of claim 20, wherein the first low noise amplifier is part of a wireless local area network (WLAN) transceiver.

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22. The apparatus of claim 20, wherein the second low noise amplifier is coupled to receive a radio frequency (RF) signal modulated using an orthogonal frequency division multiplexing (OFDM) modulation scheme and wherein the RF signal has a power level of less than about -90 dBm and wherein the first low noise amplifier
20 has a gain of at least about 20 dB and a noise figure less than about 10 dB and wherein the second LNA has a gain of at least about 30 dB and a noise figure less than about 4 dB.

23. An apparatus to extend communication range in a wireless personal area network (WPAN) system, a wireless local area network (WLAN) system, or a wireless metropolitan area network (WMAN) system, comprising:

- 5 a first power amplifier (PA);
- a first low noise amplifier (LNA);
- a first circulator having a first terminal coupled to a first terminal of the first power amplifier and a second terminal coupled to a first terminal of the first low noise amplifier;
- and
- 10 a second circulator having a first terminal coupled to a second terminal of the power amplifier and a second terminal coupled to a second terminal of the first low noise amplifier.

24. The apparatus of claim 23, wherein the WLAN system is a system

15 substantially based on an Industrial Electrical and Electronics Engineers (IEEE) 802.11 standard and the WMAN system is a system substantially based on an Industrial Electrical and Electronics Engineers (IEEE) 802.16 standard.

25. The apparatus of claim 23, wherein the first circulator has a third terminal coupled to a first terminal of the apparatus and the second circulator has a third terminal coupled to a second terminal of the apparatus and wherein the apparatus further comprises a second low noise amplifier having a first terminal coupled to a third terminal of the apparatus and a second terminal coupled to a fourth terminal of the apparatus.

26. The apparatus of claim 25, wherein the second terminal of the apparatus is adapted to be coupled to a primary antenna and the third terminal of the apparatus is adapted to be coupled to a diversity antenna.

27. The apparatus of claim 23, wherein the first power amplifier has an output power of about 30 dBm or less and the first low noise amplifier has a gain of at least about 30 dB and a noise figure of less than about 6 dB.

28. A system, comprising:

a range extender coupled to receive a signal from a wireless local area network (WLAN) device, wherein the range extender comprises:

a first power amplifier (PA);

5 a first low noise amplifier (LNA);

a first circulator having a first terminal coupled to a first terminal of the first power amplifier and a second terminal coupled to a first terminal of the first low noise amplifier; and

10 a second circulator having a first terminal coupled to a second terminal of the power amplifier and a second terminal coupled to a second terminal of the first low noise amplifier.

29. The system of claim 28, wherein the WLAN device is an Industrial Electrical and Electronics Engineers (IEEE) 802.11 access point (AP).

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30. The system of claim 28, further comprising a second low noise amplifier having a first terminal coupled to a first terminal of the range extender and a second terminal coupled to a second terminal of the range extender.

20 31. A method, comprising:

transmitting a wireless local area network (WLAN) radio frequency (RF) signal using two discrete power amplifiers.

32. The method of claim 31, further comprising:
receiving a wireless local area network (WLAN) radio frequency (RF) signal
using two discrete low noise amplifiers.

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33. The method of claim 31, wherein the wireless local area network (WLAN)
radio frequency (RF) signal is a signal generated using a protocol substantially based
on an Industrial Electrical and Electronics Engineers (IEEE) 802.11 standard.